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ABSTRACT

The Commission on Instructional Technology, in their deliberations, must face a current pessimism among those involved in adapting technology to education. C. F. Hoban lists a number of factors that are responsible for this, and which indicate that many problems of instructional technology are not intrinsic and peculiar to it, but are part of "more universal problems of institutionalized school instruction and of old and new academic disciplines and professional bureaucracies which aspire to sovereignty over the instructional process". Teacher resistance, which stems from the historically ritualistic role of the classroom teacher, constitutes a major problem. The attitude of a teacher may facilitate or impede a program, even when his sole function is to maintain order. It is, therefore, the whole system of instruction that the Commission must reappraise, rather than the installation of appliances or the design of school buildings. (GO)

Instruction as a Systematic Approach to Instructional Technology

by Charles F. Hoban*

I. CONTINGENCIES OF THE COMMISSION'S MISSION

Commissioner Howe's imperative to his Commission on Instructional Technology that "It must consider every aspect of instructional technology and every problem which may arise in its development"** implies either a prescience of the Commission and its facilities which is unrealistic, or a life span of deliberation which is incongruous with the prevailing national demand for instant plans, insights, and R & D mappings complete to the last coordinate.

Given its task, however, the Commission's assignment is complicated by a posture of pessimism of the new power structure of instructional technology, or "learning systems," particularly among those involved in adapting computers to direct instruction or to the management of instruction. This posture appears to be based on the half-truths that all major instructional technological devices (motion pictures, ITV, etc.) have been oversold in the past, that they have not lived up to overstated performance promises when adopted by the schools. Consequently all technological innovations, including those in various stages of R & D, are viewed as vulnerable to the dreadful disclosure of fraud when submitted to the pragmatic test of trial and adoption in school instruction.

II. FACTORS UNDERLYING PESSIMISM IN THE ESTABLISHMENT

Underlying this currently fashionable attitude of pessimism or defeatism are several major readily identifiable factors, which lie deep

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** Emphasis added.

in the educational system as first causes of problems of all instruction. The relationship of these underlying factors are well known to those who over the years have (a) participated directly in technological innovation in public school systems, colleges, and mass military training; (b) done both contextual and evaluation research on what hitherto have been known as "new media in education"; and (c) have tried to develop viable theories dealing with the "new media in instruction." Among these major factors which impede instructional technology and inhibit optimization of its effectiveness are the following:

1. An overexpectation of effects from any given gadget or process, simple or complex, adapted to instruction from some other area, such as entertainment (motion pictures, television), automated industrial processes and commercial transactions (computers); weapons systems research and development (programmed instruction, systems analysis).

2. "Measurement of effects" (evaluation) of the "new media" by instruments and techniques which are non-metric in the mathematical sense of measurement and insensitive to dimensions of human response that may be of much greater importance than the "behavioral objectives" they are designed to "measure."

3. A scientistic outlook among learning psychologists, instructional systems analysts and designers, programmed instruction developers, etc., which (a) ignores the importance and operation of intuition in classroom interaction, and (b) prescribes narrow behavioral objectives and their criterial "measures" (See 2 above).

4. An inertial property of educational and adjunct institutions which makes them resistant to change, slow to innovate, and methodologically

non-adaptive when innovation is tried.

5. An irrelevance of much of learning psychology to classroom teaching situations as they exist in reality, rather than in psychology laboratories.

6. A curriculum which is frequently misphased, overintellectualized, and irrelevant to the individual needs and social milieu of large numbers of students, and consequently operative at best among bright and/or docile students responsive to pressures for compliance from both parents and teachers.

7. An overextended period of packaged preparatory education which induces boredom and maintains the status quo in a seller's market in formal education, and an underdeveloped program of continuing education which, incidentally, is particularly open and adaptable to instructional technology.

8. A narrow exclusiveness in the educational establishment, including the U. S. Office of Education and professional organizations of educational institutions and institutional teachers, which equates education and instruction with public (and private) school systems and colleges, and ignores the educational and training programs of business, industry, the military services, etc.

This list of factors can easily be extended. The eight listed above are sufficient to indicate that many problems of instructional technology are not unique to instructional technology as such, but are embedded in the broader and more universal problems of institutionalized school instruction and of old and new academic disciplines and professional bureaucracies which aspire to sovereignty over the instructional process.

III. THE CONCEPT OF INSTRUCTIONAL TECHNOLOGY

It seems the better part of valor in the present state of national puzzlement and confusion for the Commission to adopt a moderate view of the scope of instructional technology. Otherwise, it will become involved in a range of concerns from team teaching to underground, windowless schools, with great attention given to depth-psychology of color selection.

Essentially, instructional technology involves the management of ideas, procedures, machines, and people in the instructional process. As such, it involves:

(1) a physical device(s) which mediates information transmission;

(2) a system of instruction of which this device(s) is one of several components; and

(3) a range of mediating options involving progression in

(a) requirements for physical alteration of the "classroom";

(b) remoteness in time and space between the tutor-planner and the student;

(c) sophistication of design of programmed information exchange between "tutor" and student;

(d) complexity and cost of hardware;

(e) level of technical skills required for equipment construction, installation, "de-bugging," operation, and maintenance;

(f) independence of classroom teacher control or continuous monitoring in the operation of the device-

centered "teaching";

(g) additional manpower required by way of paraprofessional personnel for use of the instructional technology; and

(h) role changes and new skills required of "classroom" teachers in (I) management of the technology, and (II) other and/or new non-structured, non-mediated teaching activities essential to personality development, humanistic growth, and cultivation of values, all of which lie outside the present and foreseeable potential of instructional technology as herein considered.

While the progression in technological devices in (3) above is not deliberately sequenced in order of increasing resistance to technological innovations in education, it is apparent that such a heuristic resistance sequence is implicit. There is presumably much less teacher resistance, for instance, to adoption of the overhead projector operated under complete control of the classroom teacher and requiring only easily manageable control of room illumination than to a purchased set of programmed instruction in which the classroom teacher does not even have control over the checking of correct and incorrect student responses.

IV. CLASSROOM TEACHER RITUALS

The current and historical role of the classroom teacher is highly ritualized. Any major change in ritual is likely to be resisted as an

invasion of the sanctuary by the barbarians.

Ritualization in teaching is flexible enough to permit idiosyncrasies of personal style, arrangement of the daily schedule, police methods, pacing, etc., but major characteristics of ritual tend to be invariant.

Two of the great invariants are (1) complete control (within institutional limits of courses of study, textbooks, films, etc.) of the teaching-testing-grading-reward-punishment processes, and (2) face-to-face interaction with students. These two invariants of ritualization of teaching are very likely to be important determinants in the trial and adoption of technological innovation and in its effectiveness in either event at the classroom level.

Any sudden or substantial reduction of dominance status and/or domain of activities of the classroom teacher, any major change in the interpersonal teacher-student communication situation, or any systematic attempt to scientize and rationalize the intuitively determined interaction patterns of the teacher is likely to elicit at least some teacher hostility and resistance.

The attitude of the classroom teacher toward any instructional innovation -- technological or otherwise -- is of paramount importance, even when unintentionally expressed, as will be discussed immediately below. While trial or adoption of innovation may be formalized at the federal, state levels, or community levels of control, it is in the individual school and individual classroom that the transaction occurs functionally (or disfunctionally).

Indeed, it may be that the more or less generally accepted theory of instructional innovation as (a) originating from the outside (the supra system), and (b) proceeding from the top down in the hierarchical structure, carries within it the seeds of its own failures or imperfections by omitting participation of classroom teachers in adaptation and adoption decisions at the local implementation level.

Some remarkable research findings with direct bearing on the effects of teacher attitudes on student behavior are currently being spelled out by Robert Rosenthal and his associates using the concept of communication of expectancy.

It will be recalled that in widely reported studies of the introduction of programmed instruction in both Manhasset, Long Island, and Denver, Colorado, it was reported that students performed better under teachers favorable to programmed instruction even when the sole function of the teacher was to maintain order. Put another way, better results were obtained from students under programmed instruction when the expectancy of teachers was in a favorable direction, and this expectancy effect occurred independent of the participational activity role of the teachers in the instructional process.

Apparently, human beings are highly sensitive to both intended and unintended expectancy cueing behavior of other human beings in dominant roles. Rosenthal reports that in an experiment on perception of people, subjects were asked to rate experimenters on the "honesty" variable. This variable could be operative only after the experiment, and could occur in tabulating and summing the results. Errors in tabulation could be random or in the direction of confirming the hypothesis held by the experimenter, and tabulation and computational errors could be large or small.

Both tabulation and computational errors occurred. Among those who erred in the direction of the expectancy of their hypotheses, both tabulation and computational errors were larger.

The experimental result especially relevant here is that, whereas all experimenters were rated by their subjects as honest, mean ratings by subjects on the honesty scale were significantly lower (moderately to highly honest vs. extremely honest) for those experimenters who made computational errors in the direction of their hypothesis. This suggests that subjects in the experiment were able to detect some cues in the behavior of experimenters which predicted beyond chance the subsequent "honest" and "dishonest" (or "less honest") errors in tabulation and computation of experimental data.

This apparent sensitivity of subjects (mostly students) to unintentional and perhaps non-formally coded cues to expectancy of results manifested by authority figures in an authority-structured social situation can, without straining the powers of reason to the point of collapse, be related to teacher influence on student performance in the direction of their expectancy hypothesis in the Manhasset and Denver trials of programmed instruction--especially when monitoring teachers exercised only the police function of preserving order in the classroom.

Even more remarkable results of teacher expectancy on student development of competencies are reported in a forthcoming (September, 1968) book, Pygmalion in the Classroom, by Robert Rosenthal and Lenore Jacobson. Teachers were told that 20 percent of the students in each class included in the reported experiment had been identified through extensive testing as having unusual potential for intellectual gains during the next year. No such extensive testing had been done. The names of the 20 percent identified as having this unusual potential were selected randomly.

The experiments were conducted in poverty area schools and involved no special programs, tutoring activities, or enrichment activities. The only new element was that of favorable teacher expectation -- teacher attitude toward the "unusual" pupils -- and presumably consequent verbal and non-verbal expression by the teachers of this attitude toward these students.

After eight months, the "unusual" students made significantly greater gains in IQ than the non-unusuals, and the non-unusuals made greater gains than did those in classes not included in the experiment.

The implications of these findings are difficult to overestimate. They clearly suggest that (a) teacher expectancy, often operating at the unintentional level, is a variable of major importance in the instructional and developmental processes; (b) students are highly sensitive and responsive to teacher expectancy along several dimensions of perception and growth; and (c) the effects of "host-specific" expectation are infectious.

It is reasonable to assume teacher expectancy operates negatively as well as positively, as suggested by the Manhasset and Denver findings. That is, negative teacher expectancy can have a depressing, or leveling, or inhibiting, or hostility-arousing effect on student development. Yet, as far as I know, teacher selection and certification procedures do not ordinarily include the criterion of the true believer in the "unusual" growth potential of students.

It may be hypothesized that all innovators and agents of change tend to be what Hoffer calls "true believers," oriented toward a better future

of mankind, an improvement of the human condition of everyone, and that one of the most important aspects of instructional technology is the inherent expectancy of educational improvement shared by its advocates. The corollary is that instructional technology fails or disappoints when its implementation falls into the hands of skeptics and infidels whose habituated classroom rituals have attained doctrinal significance, and consequently whose expectancy of ritualistic change is negative.

V. CRYSTALIZATION OF THE ARGUMENT

To crystalize the argument, it should be borne in mind that

(a) many of the troublesome problems of instructional technology are essentially further manifestations of the troublesome problems and properties of instruction in the American educational system;

(b) the fashionable attitude of pessimism and pooh-pooh toward instructional technology is particularly evident among an elite of the supra educational establishment for whom the world of instructional technology originated last year or the year before and consists largely of promised but undelivered computer regulation of the process of individualized, multi-tracked instructional programs, task assignments, and performance monitoring;

(c) at least some, if not many, of the significant variables of in-school growth and development of students lie beyond the cognizance of learning psychology, and the consequences of these variables escape the narrowly prescribed "first order,"

behaviorally operationalized objectives of instruction and their criterial "measures";

(c) the process of innovation has been studied on the normative rather than the explanatory, i.e., theoretical, level and consequently the literature on innovation provides few cues for acceleration and adoption of desirable changes in the system of instruction; and

(d) the classroom teacher is by training and institutional control a prisoner of the orthodox ritualization of the educational system, negatively disposed to automation, and less of a gatekeeper than a positive or negative expectancy radiator.

VI. GUIDELINES FOR THE COMMISSION

(a) The Institutional Context of Instructional Technology

It follows that substantial, difficult, and not-clearly-defined changes must be made in the educational system both for its own effective survival and in order to accelerate the rate of development, adoption, and optimum use of instructional technology, assuming that instructional technology can be justified in the first place. This reconstruction is beyond the ken of the Commission on Instructional Technology, but recognition of its necessity is not.

A clear implication for the Commission is that it articulate its concern that instructional technology center on those areas of education

that, by general concensus, are in greatest need of attention, e.g., the three R's -- reading,'rithmetic, and relevance. Parenthetically, the "new math," particularly in the elementary school, may not enjoy consensual approval at any level of expertise, and the linguistics approach to the teaching of language is regarded as premature and error prone by at least some with impressive credentials in both linguistics and education.

(b) Justification of Instructional Technology

Instructional technology is more justified by its own logic than by empirical studies of its effectiveness in facilitating "learning." As already indicated, such empirical (evaluative) studies unfortunately ignore critical variables, and typically "measure" only those results which are easiest to operationalize within the state of the art of criterial specification and educational testing. The notion of "unobtrusive measures" has scarcely penetrated educational research, and at least some of the vigorously promoted techniques of multivariate analysis are too often used as a substitute for thinking or to elegantly demonstrate the obvious. This is not to say that empirical research has no place in uncovering important relationships or evaluating procedures and progress in instruction, but only that too often it is overburdened by techniques and designed with impoverished insight and imagination.

The development, use, and improvement of instructional technology, as defined in this memorandum, is justified in a broad general way by the fact that American schools operate as a formative institution of a highly technological society and should therefore incorporate, as appropriate, this

characteristic of the larger society as well as its idealized values. In a sense, this principle of justification is aesthetic and can rest at that without decisive challenge.

However, since aesthetics generates much subjectivity and little objectivity, stimulates lofty dialogue at the philosophical level and restless, insistent controversy in relation to specific events, it is desirable to get down to tangible criteria in justifying instructional technology.

For what it is worth, it may be said reflectively that instructional technology is justified if and when it:

(1) makes available, discretely or continuously, a mode or multimodes of representation of any of several levels of reality, culturally recognizable as such, and without constraints of geography or of real time, and hitherto not available for instruction or non-tutorial education;

(2) provides a model of behavior otherwise unavailable, or in scarce supply, or lacking authenticity or correctness of definition, and preferably when it provides opportunity for the student to compare his imitative behavior with that of the model;

(3) sequences and, within reasonable limits and without undue restraints, manages stimulus inputs and response outputs on an individualized and structured basis otherwise difficult or impossible to achieve;

(4) stores, retrieves, and rapidly processes a large amount of relevant information not otherwise readily available, or, if available, too time-consuming to process manually;

(5) involves latent functions of a critical nature in the instructional process or system which, because they are not directly and immediately related to improved and "measured" student progress, may escape proper assessment or even official observation.

None of these five criteria is necessarily independent of the other four. All can be combined in complex hardware and electronic components. Also, it goes without saying that this brief list of criteria is not intended to be either definitive or exhaustive.

(c) Minimizing Contingencies of Instructional Technology

Again, for what it is worth, it may be said reflectively, and with some empirical evidence, that the effectiveness of instructional technology will be less than optimum if and when it:

(1) incorporates the format of other modes of instruction known to be relatively inefficient and ineffective instructionally, i.e., when McLuhan's "rearview mirror" effect occurs;

(2) fails to challenge or slows down the natural pace of progression of students and thus induces student boredom an/or resentment;

(3) rapidly reaches a point of diminishing returns and thus becomes monotonous and unrewarding.

(4) severely and continuously reduces the social process of education, i.e., face-to-face interpersonal interactions, group participation, etc.;

(5) requires logistical support beyond the capacity of the system to provide in proper time-phase and matching characteristics, and without heavy incumberance of hardware, additional personnel, or hard-to-find dollars.

VII. PRIORITIES AND EMPHASES

It may reasonably be expected that the Commission on Instructional Technology will come to some decisions on priorities. A set of questions such as the following should be considered and priorities of emphasis recommended:

1.1. Should motion pictures, film strips, radio, and other media, which are currently not considered as technological innovations but as adoptions, be taken for granted, or should they be re-examined for: currency of content, state of the art such as employment of more involving and perhaps less isomorphic symbolism, extent of adoption, logistical adequacy, etc.?

1.2. Should emphasis now placed on the newer technologies, such as ITV and PTV, Individually Prescribed Instruction, Computer

Regulated Instruction, etc., be intensified, or should they undergo more extensive feasibility, operational suitability, and effectiveness testing, bearing in mind the kinds of variables already discussed, and the present limitations and necessary modifications of research procedures and techniques?

2.1. Should efforts to diffuse instructional technology and increase its effectiveness be time-phased from the elementary school, which is more open to innovation, and progressively to the high school and college which are discriminably more conservative and less open to changes in teacher role and ritual?

2.2. Should the efforts to diffuse instructional technology and increase its effectiveness be more emphasized among formally certified "systems" of education, such as public schools and colleges, which defy systems analysis simply because they are systematically chaotic, or should they be more emphasized on the para-formal educational institutions of industry, commerce, and the military services which are well systematized and more definitively goal oriented?

3.1. Within the formally structured and certified educational "systems," should emphases on the employment of instructional technology be directed to use among those schools serving the "culturally deprived" student population, or

should it be directed to use among those schools serving the family reinforced, docile, compliant and thus more "teachable" student population?

3.2. Again within the formally structured and certified educational "systems," should emphasis on instructional technology be placed on the full-time day student population, or on the continuing education population among whom the struggle is greater, the need more acute, and the motivation possibly stronger?

As previously, this list of questions is not exhaustive, and their either-or formulation does not exclude the middle from consideration. Omitted from the list are questions dealing with the very important issues of teacher education, strategies of innovation, and research methodologies. Such questions are implicit in various foregoing sections. Also omitted are questions of use of technology in public relations, class scheduling, library controls, etc., not because they are unimportant but because they do not deal directly with instruction. However, the Commission would be in error if it were to ignore these areas of application.

VIII. THE SYSTEMS APPROACH

Throughout the above discussion, the systems concept is embedded in various points. Like cost effectiveness, operations research, the affective domain and other terms on current display in the best company, the systems concept is being flogged mercilessly in educational discourse; nevertheless

it is imperative that the Commission on Instructional Technology approach its task within a central concept of instruction as a system, and not as the installation of appliances, or the design of school buildings in the round. A system is an arrangement in which everything is related to everything else so that the malfunctioning of any part affects the output or outcome. It was, among other things, to emphasize this interrelationship that the preceding discussion of the role of authority expectancy and subject behavior was introduced and discussed.

The systems concept is not fully explicated or articulated in its educational applications and implications but its seminal ideas are clear and simple and need not await the master blueprint to be accepted and acted upon. Perhaps those simple little flow charts with boxes, circles, and arrows,that appear so elegantly professional and slightly awesome in the new educational literature, are a necessary and useful way of beginning to take a fresh look at instructional technology.